

**01268**

1990/03/27

# AGREEMENT-IN-PRINCIPLE

between the

STATE SEISMOLOGICAL BUREAU, PEOPLE'S REPUBLIC OF CHINA

and the

UNITED STATES GEOLOGICAL SURVEY

under Annex I of the Earthquake Studies Protocol

for

## UPGRADES TO THE CHINA DIGITAL SEISMOGRAPH NETWORK

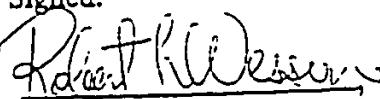
27 March 1990

Signed:

  
Gu Ping, PRC Side  
Chief, Department of International  
Cooperation, State Seismological Bureau

Date: May 8 1990

Signed:

  
Robert L. Wesson, USA Side  
Chief, Office of Earthquakes, Volcanoes,  
and Engineering, USGS

Date: March 27 1990

## I. INTRODUCTION

The CDSN has been in operation since 1986, and has been producing high quality digital data for research seismologists world wide since early 1987. The CDSN data are made available to the research community through the CDSN Data Management Center (DMC) in Beijing, the USGS Albuquerque Seismological Laboratory (ASL), and the USGS National Earthquake Information Center (NEIC) in Golden, Colorado. These data are distributed by the CDSN DMC in the form of Network Day Tapes, by ASL as global network day tapes or volumes written in SEED (Standard for the Exchange of Earthquake Data) Format, and by NEIC in the form of CD ROM optical disks containing event data. The SEED volumes produced by ASL take the place of the Network Day Tapes produced previously by ASL. SEED volumes (presently tapes) are written in a standard format agreed upon by a significant portion of the international seismological community. Research seismologists are finding the inclusion of the CDSN data in the published data volumes to be a valuable asset in their studies. For example, the recent (Nov. 1988) large earthquake in Yunnan province can be studied in much greater detail because of the availability of CDSN digital data.

However, this particular earthquake pointed to the need for even greater dynamic range than is available in the present CDSN system. There was evidence of clipping on at least some channels at each of the five stations from which ASL receives data on a regular basis. The lowest gain channels are the broadband channels, and these did not show evidence of clipping except at Kunming. Installation of IRIS/GSN (also known as IRIS-2) equipment at the stations would allow the recording of broadband (BB) data at five times lower sensitivity than in the CDSN, so that large earthquakes would be even more likely to be recorded without clipping. Also the BB data would be recorded continuously instead of being triggered. The IRIS-2 data loggers may also be equipped with optional very short period (VSP) and low gain (LG) sensors to allow the recording of high frequency (up to 50 Hz) and high amplitude (up to 2g) waveforms of local and regional interest.

The desired capabilities for a Global Seismographic Network (GSN) of digital seismographic stations were defined as a result of the IRIS initiative. In 1984, the Incorporated Research Institutions for Seismology (IRIS) prepared a Science Plan for a New Global Seismographic Network (GSN). This plan was submitted to the US National Science Foundation (NSF) and resulted in a cooperative program between IRIS, NSF, and the USGS, to develop and install a modern digital broadband seismograph network of 50 to 100 stations distributed evenly around the globe. Based on the Science Plan's requirements, "The Design Goals For A New Global Seismographic Network," dated March 13, 1985, and a "5-Year Siting Plan IRIS Contribution to the Global

Digital Seismographic Network," dated March 28, 1986, were prepared. These two documents state in detail the technical specifications and the proposed station locations for the GSN stations.

The *Siting Plan* depends on the CDSN stations for seismographic coverage of China, as an integral part of the GSN. However, the CDSN stations do not presently meet all of the IRIS technical specifications in the *Design Goals*. In order for the CDSN to become a fully participating partner in the GSN program, it will be necessary to upgrade the CDSN stations and the DMC equipment to meet IRIS standards. These standards include:

1. **BANDWIDTH:** Sufficient bandwidth to adequately record the entire spectrum of seismic signals that propagate over distances that are large compared with the station separation, on the order of 20 degrees for a 100 station network. Broadband data should be recorded continuously at 20 samples per second, with higher frequency channels recorded on an event basis.
2. **RESOLUTION AND FULL-SCALE:** Over the specified bandwidth, the system should be capable of resolving signals at the level of minimum ambient ground noise and of recording signals from the largest expected teleseismic event. Neither the full scale clipping nor the system noise should obscure any signal of interest.
3. **LINEARITY:** The system output should be a linear time-invariant function of the ground motion. Further, the linearity should be such that signals near the ground noise minimum can be resolved in the presence of ground noise at other frequencies near the expected ground noise maximum.

In addition to these design goals, the GSN systems also have the ability to transmit any or all of the acquired data via a serial port to a host computer or central receiving station. There is also a dial-up port that may be connected to a telephone line or modem so that buffered data may be retrieved by calling the station processor from another computer. Up to six channels of LP or SP analog outputs are available for use in producing conventional analog seismograms on drum recorders.

The recording systems proposed for upgrading the CDSN over the next two to three years will meet all of the design goals for the GSN. In addition, the new DMC equipment proposed will be able to read tape cartridges from the upgraded stations and compile SEED network volumes from them and from existing CDSN tape cartridges.

In preparation for installation of IRIS-2 seismic data systems in China under this Agreement, the USGS and the SSB agree to cooperate in the early installation of Sun seismic data systems at four CDSN stations, and to telemeter

seismic data from these stations to the DMC in Beijing and to ASL. ASL will transmit event parameter data to the DMC in Beijing over the reverse link. The Sun seismic data systems at each station will operate for about one year or until an IRIS-2 data system is installed at that station. At that time, the Sun system may be attached to the IRIS-2 system as a work station, it may be moved as a complete system to another station, or it may be left in place and continue to be used as before.

The USGS will let a contract for the installation work and the training. The USGS field engineer in China and the SSB will assist the USGS and its contractor in installation of the Sun seismic data systems and telemetry links.

## II. PURPOSE

The purpose of this Agreement-In-Principle is to list the steps necessary for upgrading the present China Digital Seismograph Network (CDSN) to be compatible with IRIS/GSN standards, to install Sun systems at four stations, and to assign the responsibilities and costs for each item to the PRC side or the USA side. This Agreement-In-Principle is understood by both sides to be within the original terms and conditions of Annex I to the Earthquake Studies Protocol, signed in 1980 by the State Seismological Bureau (SSB), the U. S. Geological Survey (USGS), and the U. S. National Science Foundation (NSF). It will result in an upgraded and expanded seismograph network in China, consisting of 10 IRIS/GSN-type stations, four stations with Sun systems and work stations, an upgraded Data Management Center (DMC), and an upgraded Network Maintenance Center or Depot (NMC). It will also result in data being telemetered by satellite from some stations to the DMC and from the DMC to the USA, and in earthquake parameter data being telemetered from ASL to the DMC in Beijing.

As with all cooperative activities under the USGS Protocol on Earthquake Studies, this activity is subject to the availability of funds.

### III. USA SIDE RESPONSIBILITIES

#### A. Install Sun Seismic Data Systems.

1. At four CDSN stations, install a Sun seismic data system, including three short period seismometers, three broad band seismometers, digitizing system, digital recorder, work station, and Uninterruptible Power System (UPS). This equipment will be installed in addition to the current CDSN data system and seismometers.
2. The four stations will be Baijatuan (BJI - near Beijing), Lanzhou (LZH), Hailar (HIA), and Urumqi (WMQ).

#### B. Upgrade Stations To IRIS/GSN Standards.

1. Upgrade five CDSN stations by replacing the present CDSN data logger and seismometer system with IRIS-2 data logger, VBB seismometer system, and possibly very short period (VSP) and/or low gain (LG) seismometer systems (optional).
2. The five stations will be:  
Kunming (KMI), Mudanjiang (MDJ), Enshi (ENH), Qiongzhong (QIZ), and Sheshan (SSE).
3. Upgrade the remaining four stations of the CDSN network, plus a new site at Lhasa, by replacing the present CDSN data logger and seismometer system with IRIS-2 data logger, VBB seismometer system, and possibly very short period (VSP) and/or low gain (LG) seismometer systems (optional).
4. The four stations in addition to the station at Lhasa will be:  
BJI, LZH, HIA, and WMQ.
5. This will result in a total of 10 CDSN stations that fully meet IRIS/GSN standards.

#### C. Telemeter Data To Beijing And ASL.

##### 1. Telemeter Sun System Data To Beijing And ASL:

Telemeter basically continuous VBB, LP, and SP data from the Sun systems at stations BJI, LZH, HIA, and WMQ to the DMC in Beijing and to ASL. The USGS and its contractor will work through the SSB with the China Broadcast Satellite Corporation (CBSC) in establishing two-way satellite links from each station to the DMC. This responsibility includes the purchase and installation of VSAT electronics and antennas, satellite link lease costs, and installation of a land link or other surface link (such as a microwave link) from the CBSC Hub (Central Earth Station) to the DMC. It also includes the responsibility for any necessary land link for connecting the DMC to the out-going satellite link to the USA.

The land link or other surface link from the CBSC Hub to the DMC will be installed with a minimum capacity of 112,000 bits per second to allow for future expansion by SSB.

2. Telemeter IRIS-2 System Data To Beijing And ASL:

For stations BJI, LZH, HIA, KMI, WMQ, and Lhasa (after upgraded to IRIS-2), telemeter basically continuous very broad band (VBB) and LP data, very short period (VSP) events, and low gain (LG) events from the IRIS-2 systems to the DMC in Beijing, and from the DMC to the Albuquerque Seismological Laboratory (ASL).

3. Telemeter event parameter data from the National Earthquake Information Center (NEIC) in Golden, Colorado, through ASL to the DMC in Beijing on the reverse satellite link. Telemeter parameters for all events detected in China greater than Richter magnitude 5 and for all other events in the world greater than magnitude 6, if available. Also telemeter to the DMC event waveforms, if available, upon special request from the DMC.

D. Upgrade Data Management Center.

1. Upgrade the computer equipment of the DMC to Digital Equipment Corporation (DEC) Microvax III computer(s), capable of writing SEED network volumes from IRIS-2 station tape cartridges and from current-type CDSN station tape cartridges.
2. Install in the DMC one or two Sun computers to be used as telecommunications computers to receive data from Sun systems and/or IRIS-2 systems at the stations and transmit data to ASL, to receive event parameter data from ASL, and to function as a work station. Connect the Sun computer(s) to the DEC computer(s) via DECNET.
3. Provide and install one IBM PC compatible computer in the DMC and connect it to the DEC computer(s) via DECNET.
4. Insure that the DMC will be capable of producing copies of station tapes, SEED network volumes, and possibly other data sets, on a variety of media that are convenient for data users. These media will include IBM PC floppy disks, station-type cartridges (150 Mbytes), Exabyte cartridges (1.5 Gbytes), and possibly 9-track tapes. If Exabyte cartridge drives are not exportable to China, a substitute high-capacity medium and drive will be provided.

E. Training.

1. Sun System Training For NMC And DMC People:

Sun system training in the USA will be provided for two NMC and two DMC technical English-speaking people who can prove equal to

this task, for two to three weeks.

2. IRIS-2 System Training For NMC And DMC People:

IRIS-2 system training for NMC and DMC people will be provided in a single training period in the USA for a total of 25 man-weeks (for example, 5 PRC people for 5 weeks). SSB agrees to send good technical people who can speak and understand English reasonably well. This training will take place just before the first station upgrades begin. Additional training will be provided in Beijing after the upgrades begin.

3. Station Operator Training:

Sun system training for station operators will be provided in China at the time of Sun system installation, either in Beijing or at the station site, at SSB's preference.

IRIS-2 system training for station operators will be provided in China at the time of IRIS-2 system installation, either in Beijing or at the station site, at SSB's preference.

F. Upgrade The Network Maintenance Center, Provide Spare Parts.

1. NMC Equipment And Parts For The Sun Systems:

Stock the NMC with spare parts and equipment for station systems and DMC telecommunications computer at a level sufficient to keep the Sun systems operating at a high percentage of up-time, and maintain that level of stock for the duration of the Sun system experiment.

2. NMC Equipment And Parts For The IRIS-2 Systems:

Provide one complete IRIS-2 station data acquisition system and install in the NMC, to be used for depot maintenance and check-out of station spare parts.

3. Stock the NMC with spare parts for IRIS-2 station systems at a level sufficient to keep the entire network operating at a high percentage of up-time, and maintain that level of stock for the duration of the cooperative agreement between SSB and USGS for operating the CDSN IRIS-2 network.

4. Upgrade and augment NMC test equipment as necessary for proper support and maintenance of the IRIS-2 data acquisition systems.

5. Provide one IBM PC compatible computer for the NMC, to be used as a diagnostic tool for the IRIS-2 station systems and for use in inventorying NMC spare parts.

G. Equipment For One Additional CDSN Station.

1. Ship one current-type CDSN system, including data acquisition system and UPS, to China for installation at Lhasa.
2. Provide technical assistance, as necessary, during installation of this equipment at Lhasa.

## H. Network Support.

### 1. Sun Network Support:

Provide support for the Sun station systems and the Sun telecommunications computer. Provide field assistance in China as necessary to support the installation, operation, and maintenance of the Sun network. Provide operating supplies that are not available in China.

### 2. IRIS-2 Network And CDSN Support:

Continue to provide support for the current-type CDSN stations and IRIS-2 upgraded CDSN stations at BJI, WMQ, LZH, HIA, KMI, MDJ, ENH, QIZ, and SSE. Provide support for the current-type CDSN equipment at Lhasa, when installed. Provide support for IRIS-2 equipment at Lhasa, when installed. Continue to provide support for the NMC and the DMC in Beijing. Provide field assistance in China as necessary to support the continuing operation and maintenance of the CDSN. Provide operating supplies that are not available in China.

### 3. DMC Maintenance:

Provide maintenance of DMC equipment as much as possible by maintenance contracts.

~~— The following is a list of the major tasks to be performed by the team in support of the Chinese地震局 (CERI) in the Lhasa area. The tasks are listed in a general order of priority, with the most critical tasks at the top of the list.~~

~~1. To assist with seismological work in PRC and assessment of available to assess and analyze data from recent earthquakes and research. This ~~work~~ will be carried out through the embassy, / residents and contractors.~~

#### IV. PRC SIDE RESPONSIBILITIES

##### A. Site Preparations For Sun Systems.

1. Perform any minor site upgrades and improvements at the four CDSN stations (BJI, LZH, HIA, and WMQ) as may be necessary for installation of the Sun systems. Also perform any necessary improvements of DMC and NMC facilities, such as additional space and better environmental controls, for installation of the Sun telecommunications computer.
2. Perform satellite signal strength tests and RF noise tests at stations BJI, LZH, HIA, and WMQ.
3. Cooperate with US technical personnel in checkout, installation, and acceptance testing of new equipment.
4. Provide all transportation of equipment in China.
5. Continue to provide daily management of the 8-station network, including the Sun systems at BJI, LZH, HIA, and WMQ. Continue to provide daily management of the DMC and the NMC, including the Sun system at the DMC.
6. Insure that seismic data are telemetered from the Sun systems at the four stations BJI, LZH, HIA, and WMQ to the DMC in Beijing, and from the DMC to ASL. Provide copies of Sun system station tapes for time periods during which telemetered data from these four stations are missing due to technical problems with the telemetry links.
7. Take whatever steps are necessary to insure that power is available to the DMC equipment 24 hours each day.

##### B. Site Preparations For CDSN System At Lhasa:

Prepare one new CDSN site at Lhasa for installation of current-type CDSN station equipment. This includes capital construction, seismometer vault or tunnel construction, and line power supply improvements, but not UPS.

##### C. Site Preparations For IRIS-2 Systems.

1. Perform necessary site upgrades and improvements at the nine existing CDSN stations to prepare for installation of IRIS-2 systems, such as improved line power, seismic noise surveys, and construction of improved seismometer vaults or tunnels. Also perform necessary improvements of DMC and NMC facilities, such as additional space and better environmental controls.
2. At stations KMI and Lhasa, perform satellite signal strength tests and RF noise tests in preparation for satellite telemetry of IRIS-2 data from those sites.

- D. Cooperate with US technical personnel in checkout, installation, and acceptance testing of new equipment.
- E. Provide all transportation of equipment in China.
- F. Provide daily management of the 10-station network, the DMC, and the NMC.
- G. Insure that data are telemetered from the IRIS-2 systems at the six stations BJI, LZH, HIA, KMI, WMQ, and Lhasa (after upgrade), to the DMC in Beijing, and from the DMC to ASL. Provide copies of ~~IRIS-2 station tape cartridges for time periods during which telemetered data from these six stations are missing due to technical problems with the telemetry links.~~
- H. Install the spare IRIS-2 station UPS in the NMC.
- I. Take whatever steps are necessary to insure that power is available to the DMC equipment 24 hours each day.
- J. If SSB wishes to telemeter data from the IRIS-2 systems at stations MDJ, ENH, QIZ, and SSE, such telemetry will be at the cost of the SSB. Any excess capacity available in the installed surface link from the CBSC Hub to the DMC may be used by SSB at no additional cost.

~~5. *... tape cartridges for time periods during which telemetered data from these six stations are missing due to technical problems with the telemetry links.*~~

~~6. *... tape cartridges for time periods during which telemetered data from these six stations are missing due to technical problems with the telemetry links.*~~

## V. PROPOSED SCHEDULE

### A. In 1990:

Install Sun systems alongside the current CDSN systems at BJI, LZH, HIA, and WMQ. Also install Sun telecommunications computer at the DMC, telemetry links from these four stations to the DMC, and a telemetry link from the DMC to ASL.

### B. In 1990 and 1991:

Upgrade stations KMI, MDJ, ENH, QIZ, and SSE with IRIS-2 systems.

### C. Beginning in 1990:

Upgrade the NMC to handle Sun systems and IRIS-2 systems. Upgrade the DMC to handle data from Sun systems and IRIS-2 systems, and to produce SEED network volumes.

### D. In 1991 and 1992:

Upgrade stations BJI, LZH, HIA, WMQ, and Lhasa with IRIS-2 systems.

中华人民共和国国家地震局和美利坚  
合众国地质调查局就列入地震研究  
议定书附件一中关于改进中国  
数字化地震台网的原则协议

签字:

国家地震局



日期 1990.5.5.

签字:

美国地质调查局



日期 7/7/90

## 一. 前言

1986 年后, 中国数字化地震台网(CDSN)已投入运行. 从 1987 年初起已取得为世界地震学家所使用的高质量数字化资料. 研究团体可通过中国北京 CDSN 的数据管理中心(DMC), 美国地质调查局的阿尔布开克地震实验室(ASL)和科罗拉多州戈尔登的美国地质调查局国家地震情报中心(NEIC)得到该台网的资料. 这些资料可由该台网的数据管理中心以网日带的形式, 阿尔布开克地震实验室以全球网日带或以地震数据交换的标准(SEED)格式编成的文件形式以及美国国家地震情报中心编成的含事件数据的 CD-ROM 光盘形式进行散发. 阿尔布开克地震实验室编成的标准文件已取代早先的网日带. 标准文件(目前的磁带)已采用得到大多数国际地震学术团体认可的标准格式写成. 地震学家们正在发现, 在已发行的资料中, 该台网数据对他们的研究有很大的帮助. 例如, 对最近(1988 年 11 月)云南省的大地震, 基于该台网数字化数据的可用性, 可进行更为深入的研究.

然而, 这一特有的地震还表明需要有比目前现有该台网系统更大的动态范围. 在常规的基础上, 阿尔布开克地震实验室得到 5 个台的资料, 每一个台至少有若干道数据已明显限幅. 最低增益信道是宽频带信道, 除昆明台外, 其它台没有明显限幅. 如在台站上安装 IRIS / GSN(也称 IRIS-2)设备, 可记录到比该台网记录灵敏度低五倍的宽频带(BB)数据, 而不会限幅. 再者, 宽频数据由连续记录代替原来的触发记录. IRIS-2 数据记录器也可配备附加的甚短周期(VSP)和低增益(LG)传感器以记录感兴趣的地方震和区域地震的

高频分量(高至 15Hz)和大振幅波形(直到 2g).

全球地震台网(GSN)的数字地震台网所期望的性能是通过 IRIS 的计划而确定的. 1984 年, 地震学联合研究集团(IRIS)拟定了 一份关于新全球地震台网(GSN)的科学计划. 该计划提交给美国科学基金会(NSF)进行审议, 结果产生了该集团、美国科学基金会、 和美国地质调查局之间一项关于研制和安装一个全球均匀分布、 由 50 至 100 个台站所组成的现代化数字宽频带地震台网的合作计划. 基于该科学计划的需要, 于 1985 年 3 月 13 日制定了“关于新全球地震台网的设计目标”, 并于 1986 年 3 月 28 日制定了“关于全球数字地震台网 IRIS 布局的五年场地计划”. 这两份文件详细规定了 台站的技术指标和建议的场地位置.

作为全球台网整体的一部分, 中国数字化地震台网台站的场地 计划取决于对中国的地震覆盖. 但是, 现有台网台站并非全部满足 IRIS 设计目标规定的技术指标. 为了使该台网成为全球台网计划 的合乎规范的参与伙伴, 必须对台网台站和数据管理中心设备进行 改进以适应 IRIS 标准. 这些标准包括:

1. 频带宽度: 足够的频带宽度可记录传播距离比台站间距大的 地震信号的全部频谱, 对于 100 个台的台网, 台站间距约为 20 度. 宽频带数据每秒采样 20 次, 连续记录, 而高频信道则以事件触发为 基础.

2. 分辨率和满量程: 对于规定的带宽, 系统可以从最低环境地 噪声水平中分辨出信号, 并记录所期望的最大远震信号. 既不会满 量程限幅又不会使系统噪声掩盖任何感兴趣的信号.

3. 线性度: 系统输出是线性时不变函数. 此外, 其线性度应在有

地动噪声的情况下,接近最小地动噪声的信号在接近所期望的地动噪声最大值的其它频带上可分辨出来.

除上述设计目标外,全球台网还有通过一系列转接站向一台三计算机或中心接受站传输任一或全部已得到的数据的能力.有一种拨号接口可连接到电话线或调制解调器上,以便用一台计算机访问基地信息处理机取回已缓存的数据.可得到多达6道长周期或短周期的模拟输出可用于在纸带记录器产生传统的模拟地震图.

为改进中国数字化地震台网,在今后二三年时间内安装的所建议的记录系统将满足全球台网的全部设计目标.此外,所建议的新的数据管理中心设备将具有阅读由改进台站得到的匣式带和编辑 SEED 台网文件的能力,也具有阅读现有台网匣式带和编辑 SEED 文件的能力.

按此协议,为准备在中国安装 IRIS-2 型地震数据系统,美国地质调查局(USGS)和中国国家地震局(SSB)同意在四个台站上先期安装 SUN 地震数据系统,并将数据由这些台站遥测到北京数据管理中心(DMC),并从该中心传输到美国阿尔布开克地震实验室(ASL),该实验室将在反向链路上把事件参数数据传输到北京.每个台站的 SUN 地震数据系统将运行大约一年或直到该台站安装一套 IRIS-2 数据系统时为止.那时,这个 SUN 系统可作为一个工作站并入 IRIS-2 系统,或者作为一个完整的系统移到另一台站,或者继续留在原地使用.

美国地质调查局将签订一项关于安装和培训的合同,由美国地质调查局派往中国的现场工程师和国家地震局将协助美方及其合同人员安装 SUN 地震数据系统和遥测链路.

## 二. 目的

该原则协议的目的是列出改进现有中国数字化地震台网以适应 IRIS / GSN 标准所需要采取的步骤, 在四个台站安装 SUN 系统, 以及规定中方和美方的职责和费用. 双方一致同意该原则协议由中国国家地震局, 美国地质调查局, 美国科学基金会于 1980 年签署的地震研究议定书附件一中原有的条款和规定. 根据此协议, 将对中国地震台网进行改进和扩展, 即由 10 个 IRIS / GSN 类型的台站, 四个具有 SUN 系统和工作站的台站, 一个改进的数据管理中心(DMC), 一个改进的台网维护中心或检修站(NMC)所组成. 同时, 一些台站的数据将依此通过卫星传输到数据管理中心, 并从该中心传输到美国以及把地震参数数据从美国传送到北京.

象所有的美国地调局执行地震研究议定书中的合作活动一样, 本项活动也受经费的制约.

## 三. 美方职责

### A. 安装 SUN 地震数据系统

1. 在其中四个台站上, 各安装一套 SUN 地震数据系统, 包括三个短周期地震计, 三个宽频带地震计, 模数转换系统, 数字记录器, 工作站和不间断电源.

2. 四个台站确定为白家庄(BJ-北京附近), 兰州(LZH), 海拉尔(HLA)和乌鲁木齐(WMQ).

### B. 改进台站以达到 IRIS / GSN 标准

1. 用 IRIS-2 型数据记录器, 差宽频地震计系统, 或差短周期

(VSP)和(或)低增益(LG)地震计系统(任选)取代现有其它五个台站的数据记录器和地震计系统.

2.这五个台站是: 昆明(KMI), 牡丹江(MDJ), 恩施(ENH), 琼中(QIZ), 和余山(SSE).

3.通过用 IRIS-2 型数据记录器, 范宽频地震计系统, 或甚短周期(VSP)和(或)低增益(LG)地震计系统(任选)取代目前台网的数据记录器和地震计系统以改进其余四个台站, 并新增设一个拉萨台站.

4.除拉萨台外, 其余四个台是: 北京, 兰州, 海拉尔和乌鲁木齐.

5.完全符合 IRIS / GSN 标准的台站总数为十个.

C. 传输数据到北京和美国:

1.遥测传输 SUN 系统数据到北京和美国:

在基本连续的基础上, 把甚宽频, 长周期和短周期数据从安装 SUN 系统的四个台站传送到北京的数据管理中心(DMC)和阿尔布开克地震实验室(ASL). 美国地调局和它的合同人员将通过国家地震局与中国广播卫星公司(CBSC)为每个台站与北京间, 北京与美国间建立双向卫星链路. 该款职责包括购置和安装 VSAT 设备和天线, 卫星通道租金和由中心地面站(CES)到中心安装一条地面链路(例如: 微波链路). 还包括提供由中心到卫星的引接和传输到美国所需的任何必要的链路. 从卫星公司插孔到数据中心的地面引接链路或地表链路应不少于 112Kb / s 的容量, 以便于地震局的扩充使用.

2.遥测传输 IRIS-2 系统数据到北京和美国:

在基本连续的基础上, 将北京, 兰州, 海拉尔, 昆明, 乌鲁木齐和拉萨(完成改进到 IRIS-2 后)的甚宽频带数据, 长周期数据, 范短周期

事件和低增益 (LG) 事件传输到北京，并从北京传输到美国。

3. 由科罗拉多州戈尔登的美国国家地震情报中心 (NEIC) 向中国北京通过反向卫星链路传输事件参数数据。关于传输所有检测到的事件参数，是指已得到的发生在中国的大于里氏震级五级的和发生在中国以外的大于里氏震级六级的事件参数。如果北京特殊需要，也将向北京传输已得到的事件波形。

#### D. 改善数据管理中心

1. 用 DEC 公司的 MICRO VAX II 计算机改善中心的计算机设备，该计算机具有将 IRIS-2 台站匝带和现有台网台站匝带的数据编写为 SEED 文件的能力。

2. 在中心安装一或二台 SUN 计算机，以用作远程通信计算机，接受台站数据和传输数据到美国。通过 DECNET 将 SUN 计算机与 DEC 计算机联机。

3. 为中央提供和安装一台 IBM PC 可兼容的计算机，通过 DECNET 使它与 DEC 计算机联机。

4. 为方便数据用户将保证中心拥有多种媒质以生产台站匝带拷贝，SEED 台网文件和可能的其它类数据集。这些媒质包括：IBM-PC 机软盘，台站型匝带 (150MB)，高容量匝带 (1.5GB)，可能还有 9 轨磁带。如果高容量匝带驱动器不准向中国出口，将提供代用的高容量媒质和驱动器。

#### E. 培训

1. 对台网两个中心的人员进行 SUN 系统培训。

每中心有两位能胜任该项工作，会讲英语的技术人员赴美培训 2 到 3 周。

2. 对台网两个中心人员进行 IRIS-2 系统培训.

在美国将安排一次对 NMC 和 DMC 人员进行 IRIS-2 系统的培训, 总数为 25 人周 (例如, 5 个中万人员 5 周). 国家地震局派具有英语听说能力和有经验的技术人员赴美. 培训将安排在第一个台站改进开始之前. 在改进开始后, 将在北京提供附加培训.

3. 台站操作员培训.

对台站操作员的 SUN 系统培训将在安装 SUN 系统时在中国进行, 具体安排由地震局确定.

对台站操作员的 IRIS-2 系统培训将在安装 IRIS-2 系统时在中国进行, 具体安排由地震局确定.

F. 改进台网维修中心(NMC), 提供备件

1. 维修中心用于 SUN 系统的设备和部件.

在维修中心存贮的用于台站系统和管理中心远程通信计算机的备件和设备必须保证 SUN 系统能以高百分率运行及满足试验期间维修所需的贮备水平. 2. 维修中心用于 IRIS-2 系统的设备和部件.

为维修中心提供一套完整的 IRIS-2 型台站数据采集设备, 以用于台站备件的检修和测试.

3. 在台网维修中心贮备足够的台站系统备件, 以保持整个台网在一个高百分率下正常运转, 并在国家地震局与美国地调局执行台网合作协议期间保持这一贮备水平.

4. 改善和增加维修中心的必需测试设备, 以进行常规支持和用于 IRIS-2 数据采集系统的检修.

5. 为维修中心提供一台 IBM-PC 兼容式计算机, 作为 IRIS-2

台站系统的一种故障诊断工具,也用于为维修中心建立备件库清单

G.关于增设一个台网台站的设备

1.向中国提供一套包括数据采集系统和不间断电源在内的现有台网类型的设备,安装在拉萨台.

2.该套设备在拉萨安装期间,视需要为中方提供技术协助.

H.关于台网支持

1.SUN 网络支持

为 SUN 台站系统和 SUN 远程通信计算机提供支持.为所需的 SUN 网络的安装,运行和维护提供现场帮助.提供在中国得不到的常规消耗品.

2.IRIS-2 台网和 CDSN 台网支持

继续对现有类型的 CDSN 台站和用 IRIS-2 型改进的北京,兰州,海拉尔,昆明,牡丹江,恩施,琼中和余山地震台提供支持.为在拉萨安装现有类型的 CDSN 仪器提供支持.为在拉萨安装的 IRIS-2 仪器提供支持.继续为北京的数据管理中心和台网维修中心提供支持.为所需的为台网的连续运行和维护提供现场帮助.提供在中国得不到的常规消耗品.

3.数据管理中心维护:

通过签订维修合同尽可能为中心设备提供维护.

四. 中方职责

A.SUN 系统的场地准备

1.在四个台站上提供安装 SUN 系统所需要的场地改造.改善

管理和维修中心的设施条件, 诸如增加空间和更好的环境控制, 以便安装 SUN 通讯计算机.

2. 在北京, 兰州, 海拉尔和乌鲁木齐四个台站进行卫星信号强度测试和 RF 噪声试验.

3. 与美方技术人员在新设备的检查, 安装和接收测试方面进行合作.

4. 提供在中国境内的所有仪器的运输.

5. 继续提供包括在北京, 兰州, 海拉尔和乌鲁木齐台的 SUN 系统在内的九个台站的台网日常管理. 继续提供包括在数据管理中心的 SUN 系统在内的数据管理中心和台网维修中心的日常管理.

6. 确保地震数据由北京, 兰州, 海拉尔, 和乌鲁木齐传到北京, 并且由北京传到美国. 提供由于遥测链路技术问题引起的从这四个台传送数据期间所丢失数据的 SUN 系统台带拷贝.

7. 采取任何需要的措施以确保数据管理中心设备每天 24 小时工作所需的供电.

#### B. 拉萨台 CDSN 系统的场地准备

在拉萨台准备一个新的场地以安装现有 CDSN 类型的台站设备. 包括基本建设, 地震计摆房或山洞建设, 电力增容, 但不包括提供 UPS 系统.

#### C. IRIS-2 系统的场地准备:

1. 在九个现有 CDSN 台站上进行必要的改造和改善以准备安装 IRIS-2 系统. 例如, 改善电网供电, 地震噪声的调查和地震计摆房或山洞条件的改善. 对数据管理中心和台网维修中心的设施也进行改善, 例如增加空间和进行较好的环境控制.

2. 在昆明台和拉萨台, 进行卫星遥测信号的强度测试和在台站进行 RF 噪声测试.

D. 与美方技术人员合作, 共同对新设备进行调试, 安装和验收测试.

E. 承担所有设备在中国国内的运输费用.

F. 承担台网十个台站, 数据管理中心和台网维修中心的日常管理.

G. 保证来自北京, 兰州, 海拉尔, 昆明, 乌鲁木齐和拉萨(改进后)六个台站的 IRIS-2 系统数据由台站传输到北京并由北京传至美国. 上述六个台站因技术问题在传输途径中引起数据丢失, 应向美方提供 IRIS-2 系统台站匣带的拷贝.

H. 在维修中心安装备用的台站 UPS 系统.

I. 采取一切必要步骤确保数据管理中心的电源供应以使数据管理中心设备每天 24 小时工作.

J. 如果中方希望由其余牡丹江, 恩施, 琼中和余山四个改进后的 CDSN 台站将数据传输到管理中心, 中方应承担传输费用. 中方不必附加任何费用就可用从卫星公司到管理中心已安装的地而链路的剩余容量.

##### 五. 建议的执行进度

###### A. 在 1990 年

在现有 CDSN 系统的北京, 兰州, 海拉尔和乌鲁木齐台安装 SUN 系统并行运转. 在管理中心安装 SUN 远程通信设备, 和安装从四个台站到管理中心的遥测链路及从管理中心到美国的遥测链

路。

B. 在 1990 年和 1991 年

用 IRIS-2 系统改进昆明, 牡丹江, 恩施, 琼中和余山台。

C. 在 1990 年初

改进台网维修中心以管理 SUN 系统和 IRIS-2 系统。改进数据管理中心以管理来自 SUN 系统和 IRIS-2 系统的数据和编辑 SEED 台网文件。

D. 在 1991 年和 1992 年

用 IRIS-2 系统改进北京, 兰州, 海拉尔, 乌鲁木齐和拉萨台。